DOCUMENT RESUME

ED 294 164 CS 009 153

AUTHOR Mikulecky, Larry
TITLE Literacy for the Workplace.
PUB DATE 88
NOTE 40p.; An earlier version of this paper apppeared in: Mikulecky, L. and Drew, R., "The Work Education Bridge," Bloomington, Indiana University, 1988.
PUB TYPE Viewpoints (120) -- Information Analyses (070)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Adult Literacy; *Basic Skills; Education Work Relationship; Employment Problems; *Functional Literacy; Illiteracy; Job Performance; Job Training; Labor Force; *Literacy Education; Reading Skills; Vocational Education; Writing Skills
IDENTIFIERS *Basic Skills Education Program; Reading Uses

ABSTRACT

Focusing on the past decade's research, this literature review concentrates on what is known about literacy demands in the workplace and the abilities of various segments of the adult and adolescent population to meet them. The review argues that since a majority of adult reading is performed upon workplace related material, understanding the nature, difficulty, and prevalence of these functional reading tasks is critical for an understanding of the reading demands encountered by adults and their abilities to meet such demands. The review suggests that the quantity and complexity of literacy demands appear to be increasing in most sectors of the workplace and that research has revealed that reading, writing, and computation in the workplace is ubiquitous and at a relatively high level. The review then discusses several studies that show that vocational training literacy demands are even higher than the workplace literacy demands. Citing figures that show generally that literacy skills demands have been increasing, the review examines several basic skills programs that apply a functional literacy approach to teaching, both in the military and in the public/private sector. The review concludes that (1) it is possible to make fairly rapid gains in the ability to comprehend technical material if training is focused on that material; and (2) in the private sector, successful technical and basic skills training programs are beginning to emerge in the vacuum left unfilled by traditional schooling. Thirty-nine references are appended. (MS)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED294164

Literacy for the Workplace

Larry Mikulecky
Indiana University

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Larry Mikulecky
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☐ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

Portions of this chapter were developed for:

Mikulecky, L. and R. Drew. (1988) "Basic Literacy and Communication Skills for Vocational Education," The Work Education Bridge. Bloomington, IN: School of Education, Indiana University.

CS007153

Literacy for the Workplace

Larry Mikulecky
Indiana University

During the last decade, a good deal of research and opinion has become available on the level and type of literacy skills required for training and participation in the workplace. This chapter reviews and synthesizes recent research, giving particular attention to what is known about the literacy demands in the workplace and the abilities of various segments of the adult and adolescent population. Later sections focus on what is known about the relationship of literacy skills to job performance and the degree to which literacy skills are generic or transferable from one setting to others. Since a majority of adult reading is performed upon workplace related material (Mikulecky, Shanklin, & Caverly, 1979), the nature, difficulty, and prevalence of these functional reading tasks is particularly important to understanding the reading demands encountered by adults and their abilities to meet such demands.

What is Basic to Functional Literacy in the Workplace

Most attempts to define literacy or establish a criteria for what is basic functional literacy tend to become muddled. Part of the explanation for this muddled situation is that literacy is not easily defined. In a recent paper for the U.S. Office of Educational Research and Improvement, Valentine (1986) addresses issues central to definitions of literacy. He points out that much of the confusion derives from the fact that there is little

agreement on what skills comprise literacy. For example, which clusters of skills comprising reading and writing are essential? One can sidestep the issue of what skills comprise reading and writing and simply look at materials that people are able or unable to read and write. This, however, creates another problem of definition: Literacy means being able to read and write which materials? Bormuth (1975) suggested that the list of materials will always differ from person to person and situation to situation, and therefore offers the definition of literacy as "the ability to respond competently to real-world reading tasks" (p. 65). Guthrie (1983) expands on this idea by noting that the "reader's literacy depends on the context of the situation, not on a specific achievement level" (p. 669).

Some writers focus on specialized forms of literacy. Sticht (1975) differentiated externally imposed literacy tasks from internally imposed tasks and defines functional literacy as

> the possession of those literacy skills needed to perform some reading task <u>imposed by an external agent</u> between the reader and a goal the reader wishes to obtain. (pp. 4-5)

Such definitions create new problems. Kirsch and Guthrie (1977-1978) pointed out that reading the same material (i.e., a news magazine) is functional for some people and leisure reading for others. Valentine (1986) suggested functional literacy is the area of overlap between print literacy and functional tasks. Presumably job literacy would be the overlap between print literacy and the myriad of functional tasks apparent in jobs ranging from fork-lift driver to surgeon. Valentine leaves it

to others to define exactly what comprises print literacy.

Rush, Moe, and Storlie (1986) refer to "occupational literacy," which they define as "the ability to competently read required, work related materials." They note further that

> by definition, functional literacy varies according to individual demands of divergent roles, settings and materials. Occupational literacy competencies comprise a subset of functional literacy. Required competencies vary from occupation to occupation and from job to job within occupations."

A good deal of research on the difficulty levels of workplace reading material suggests that the difficulty level of running prose (i.e. memos, manuals, correspondence, etc.) averages high school difficulty levels (Mikulecky, 1982; Sticht & Mikulecky, 1984; Rush, Moe, & Storlie, 1986). Since a good deal of workplace reading material is not running prose, however, using such grade level indicators is somewhat problematic.

The problem of establishing a sensible grade level indicator becomes even more problematic when the role of reader background is considered. Some workers can competently read work-related material that averages one grade level to two grade levels above the difficulty levels of general newspaperlike material that they successfully comprehend (Diehl and Mikulecky 1980; Mikulecky 1982). The authors attribute this seeming higher ability with work reading to familiarity with the topic and format of job-related material. Sticht, Amijo, Weitzman, Koffman, Roberson, Chang, and Moracco (1986) present military data that indicate a range of four grade levels of tested reading ability between the reading abilities required for job-related reading by highly

experienced workers and workers with no experience on the reading topic. This suggests that background knowledge can account for up to four grade levels of reading ability with a given topic and print format. Grade-level definitions of literacy levels are particularly ineffective as readers' background knowledge increases.

Literacy Demands in the Workplace and Workplace Training

Two decades of civilian and military research have documented and examined the range of literacy demands in the workplace. Though there are a small and shrinking number of jobs requiring little or no literacy, the amount and complexity of literacy demands appears to be increasing in most sectors of the workplace.

Workplace Literacy Demands. Research has revealed that reading, writing, and computation in the workplace is ubiquitous and at a relatively high level. Diehl and Mikulecky (1980) examined 100 workers for a representative cross section of occupations ranging from executive vice president to forklift driver. Only two percent of occupations examined required no reading or writing. Time spent reading print, charts, graphs, and computer terminals averaged nearly two hours daily. Difficulty levels of 70 percent of running prose reading materials on the job ranged from ninth to 12th-grade levels. This finding also concurs with the work of Rush, Moe, and Storlie (1986). In addition, Sticht (1982) reports similar reading times and difficulty levels for military jobs and reading materials.

Mikulecky (1982), in a comparison study of school and workplace literacy demands, found high school juniors spent less time reading, including homework, than all categories of workers except blue-collar workers. In addition, the difficulty levels of work materials were generally as difficult or more difficult than high school materials. Students unable or unwilling to read in school, and who expect to be free of reading when they are employed, are in for rude awakenings. Most of these students will find it easier to hide from literacy in school than they will in the workplace.

In addition to fairly difficult on-the-job reading materials and training materials, many high school students are unprepared for how literacy skills are used in the workplace. Most of workplace reading, writing, and computation is to accomplish tasks and make assessments. Rather than reading from a single text, workers must gather information from several sources to solve problems, provide services, and perform tasks. Research by Mikulecky and Winchester (1983) and Mikulecky and Ehlinger (1986) have found clear evidence of a strong relationship between higher-level "metacognitive" and problem-solving reading abilities and job performance across differing occupations. The ability to set purposes, self-question, summarize information, monitor comprehension, and make useful notes distinguishes superior job performers from merely adequate job performers.

A synthesis of research on workplace literacy produces several generalizations

- o Most jobs call for literacy and computation.
- o Workers use a variety of materials while high school students usually do not.
- o Literacy and computation on the job are necessary for performing tasks.
- o Workplace literacy and computation are often social phenomena involving asking questions and gathering some information from other workers.
- o Workplace literacy calls for regular use of higher-level application and metacognitive reading skills (i.e. setting purposes, self-questioning, summarizing, and monitoring), while school reading is predominantly fact gathering.

Literacy Demands of Job Training. Though workplace literacy demands are high, the vocational training literacy demands are even higher. Rush, Moe, and Storlie (1986), Sticht (1975), and Mikulecky (1982) found that reading was a daily requirement of students in training courses and in the workplace. Mikulecky (1982) found that students in job training programs actually spent more time reading texts and manuals than did high school juniors (135 minutes daily versus 97 minutes daily).

Rush, Moe, and Storlie (1986) studied training program courses for 10 occupations. They found that student reading time ranged from 42 minutes to six hours per day, depending on the occupation. They also found that students in training programs used primarily reading-to-learn strategies, and that textbooks,

reference books, and sets of complex instruction were part of the daily required reading. Students often encountered information in book-length and graphic formats as well as shorter materials (e.g., quizzes, instruction sets, chalkboard notes) in combinations of text and graphic formats in the classroom and laboratory.

In addition, Rush, Moe, and Storlie observed that the reading requirements were varied and ranged from informal notes in the classroom, to highly technical prose in textbooks. Specialized vocabulary--both true technical words and common words with special occupational meanings--was present in reading materials and was encountered in each of these types of reading.

Rush, Moe, and Storlie also studied job training materials to find how easily understood or readable they were. Readability formulas indicated that training materials ranged in difficulty from eighth-grade to college-graduate level. The authors point out that the high reading levels of materials are an additional demand on the learner, but that they are sometimes partially offset by the students' interest, motivation and familiarity with a given subject matter.

Given the amount of reading required in both training and work settings, and the highly demanding printed material students are required to read, it is clear that an individual's success in the classroom and the workplace is dependent, in part, on an ability to read and apply information obtained from complex textual and graphic materials. More than simply reading for

facts is required both of workers and of students in training programs. Literacy skills in vocational training and work settings include reading to solve problems and make judgments.

Literacy Skills Demands Have Been Increasing with Some Exceptions

Each major war during this century has brought with it increased literacy demands for military performance. During World War II, the U.S. Army found it necessary to set a minimum criterion of a fourth-grade reading level for acceptance into the Army. A special 1947 census defined literacy as five years of schooling, and found 13.5 percent of the population illiterate. By the 1960's, the U.S. Office of Education had raised the level of acceptable literacy to eight years of schooling. Even this level was considered too low in the 1970s when the Adult Performance Level study was released (Cook, 1977).

During the early 1980s, a survey of citizens in Milwaukee reported the types of materials residents considered essential to normal functioning. These materials provide a reasonable idea of what current functional literacy means to a cross section of adults. Though these materials were not specific to the workplace, the difficulty level of materials outside the workplace tends to reflect the difficulty levels of those in the workplace. Frequently mentioned materials in the Milwaukee study included relatively simple items such as street and traffic signs and medicine bottle directions to more complex items such as bank statements, health and safety pamphlets, loan applications, and product warning and antidote directions. Difficulty levels of

the more complex safety instructions and economic statements were at the 12th-grade level and higher (Negin and Krugler, 1980).

Current estimates of occupational demands for literacy indicate that over 90 percent of occupations call for some reading and writing (Diehl and Mikulecky, 1980; Mikulecky, 1982). This is up from not more than 10 percent in the first decennial census undertaken in 1790. (Tyler, 1978)

The difficulty levels of occupational reading are quite high. Nearly every civilian and military study cited above indicates levels at the high school level or above. Even blue-collar workers average more than 1-1/2 hours of daily job-reading. Though having a wealth of background knowledge on a topic can tend to effectively lower reading difficulty levels, the most heavy job-related reading is performed by new workers learning new jobs (Kern, 1980). New workers are the least likely to have a wealth of background experience. This expectation of heavy reading expected of new workers is a dramatic change from earlier times when one out of 10 workers performed the literacy tasks for others.

There are a few exceptions to the general trend of higher literacy requirements in the workplace. For example, some low-paying jobs can be simplified through fragmentation and automation. In West Germany, cost-effectiveness has resulted by breaking down complex tasks to simple tasks done repeatedly by an individual worker. This method is not as cost-effective as having a worker who is literate and can adjust flexibly to new

tasks when the operation for which he or she has been trained is temporarily halted. However, fragmentation can be cost-effective if the worker is paid an extremely low wage, as are the immigrant "guest workers" in West German industries. In the United States, where no legal guest-worker option exists, fragmented jobs tend to be shipped out of the country leaving Americans with low literacy abilities without employment. Some fast-food chains in the United States have eliminated the need for much literacy among employees by using pictures on cash-register keys and computerized pricing. A trained manager must be knowledgable and available in the event of equipment difficulties, but the system works as long as less-capable workers can accept extremely low pay for their severely limited performances. Similar approaches are being used in the automating of oil-pipeline monitoring gauges and holographic package readers in grocery stores. The grocery store example is useful for examining this low-skill job trend. Fewer mistakes and hold-ups mean faster lines and therefore the need for fewer low paid check-out personnel and packaging personnel to run and check prices. Computerized inventories also lower the need for massive warehousing and many of the warehouse jobs associated with such massive operations. Several middle-skilled-level jobs are created for building, marketing, and servicing the holographic price readers. (Harste and Mikulecky, 1984)

Problems Related to High Literacy Skill Demands. In the early 1980s, there were several indications from industry that

the education levels of new and existing workers were inadequate. According to a Center for Public Resources survey (Henry and Raymond, 1982),

> over 65% of responding companies note that basic skill deficiencies limit the job advancement of their high school graduate employees, and 73% responded that deficiencies inhibit the advancement on non-graduates. (p. 23)

Percentages of basic skills difficulties reported by employers in the survey were the following:

Secretaries having difficulty reading at the level required by the job.	30 percent
Managers and supervisors unable to write paragraphs free of mechanical errors.	50 percent
Skilled and semiskilled employees including bookkeepers unable to use decimals and fractions in math problems.	50 percent

The Wall Street Journal (Hymowitz, 1981) cited industry reports that indicate increased economic problems resulting from workers who are unable to meet the literacy skills demands of their jobs. William Barnes, vice president of finance of JLG Industries, reported that "poorly educated workers are our no. 1 problem, the main factor slowing our growth" (p. 1). JLG reported having spent over $1 million to correct worker literacy mistakes. Similarly, Mutual of New York reported "an estimated 70% of the insurance firm's correspondence must be corrected or retyped at least once." Concerns regarding the safety of workers who cannot read warnings and follow written directions have been issues in a growing number of court cases and have lead to several firings at Westinghouse Electric Corp.'s defense gear plant in Sunnyvale, Calif.

In many industries, workers with low literacy skills are being replaced. For example, following the lead of the Japanese, U.S. employers in auto industries have substantially replaced unskilled workers with robots. In 1981, General Motors reported one skilled worker for every 5.6 assembly-line workers. By late in the decade, General Motors was approaching it's goal of a 1-1 ratio of skilled and nonskilled workers (i.e. an 80 percent reduction in nonskilled positions).

The Changing Nature of Work

One indication of the changes in literacy skills required to participate in society is the changing nature of work in the United States and other industrialized countries. As new jobs are created and old jobs disappear, new levels and types of literacy skills for employment are also created. U.S. Department of Labor projections of occupational areas experiencing the biggest growth include service workers, psychiatric aides, dental assistants, claims clerks, secretaries, and salesclerks. Among jobs experiencing large declines in employment (13 to 20 percent) are farm laborers and tenants, logging workers, housekeepers, maids, and home child-care workers. These low literacy skill jobs are decreasing. In addition, many other nonskilled production jobs are being moved off-continent where nonskilled workers perform tasks for considerably lower salaries than do Americans. Among the occupations projected for the greatest growth by the Bureau of Labor Statistics are

o industrial robot production

o geriatric social worker

o energy technician

o industrial laser processing

o on-line emergency medical and genetic engineering.

These projections show that it will be increasingly difficult for workers to find adequate employment in jobs which require a low level of literacy skills.

Department of Labor data do not suggest that all new jobs will involve high-technology such as lasers or robots and call for years of specialized training. Rumberger (1984) reports that the greatest number of new jobs are unrelated to high technology. Between 1978 and 1990, the United States will need 672,000 new janitors and sextons but only 199,000 new computer systems analysts. These janitorial positions, however, usually require the ability to read manuals, manage the directions on chemical solvents, handle new equipment, and do a good deal more than simply sweep floors.

Though years of training will not be required for all new jobs, it is likely that higher minimum levels of literacy skills will be required. The growing service industries require a good deal more paperwork and regular managing of information to solve problems than did higher paying "muscle work" production industries.

There is some disagreement about which skills will be needed in the future. For example, Rumberger, (1984), maintains that there is no evidence to support the "myth" that high technology

will be the primary source of new jobs in our economy in the future. Instead, he contends,

> Most new jobs will not be in high-tech fields in the future economy, and technology will not require a vast upgrading of workers' skills, because the primary impact of technology will be to reduce the skill requirements of jobs. (p. *)

Others (Mikulecky, 1984; Stitch and Mikulecky, 1984; Rush, Moe, and Storlie, 1986) maintain that though it is true that high-tech jobs will only make up a small percentage of future jobs, jobs that have traditionally required minimal basic skills are becoming more complex, demanding higher-level reading, writing and computational skills. Some jobs will show a decrease in skill requirements, but most jobs will move from low-skill to middle-skill levels.

Who Can and Cannot Meet Occupational Literacy Demands.

Several national assessments of adult and adolescent abilities have been performed during the 1970s and 1980s. Though none of these studies directly addresses workplace literacy abilities, several items in each of these studies can allow us to draw inferences about proportions of the population likely to experience difficulty with basic skill requirements in the workplace and in vocational training.

Usually, the Adult Performance Level study (Northcutt, 1975) is used to provide estimates of the number of millions of illiterate adults. A more helpful use of the data from this study of adult reading abilities is to examine the tasks presented to adults and the percentages of adults who could not

successfully complete these tasks. Items listed below are from the Northcutt (1975) study and resemble the types of literacy skills tasks several researchers have observed in the workplace. Of the cross section of adults in the study:

- o 60 percent did not accurately calculate from advertisements price differences between new and used appliances
- o 44 percent did not successfully match want ad job requirements to personal qualifications
- o 40 percent did not accurately determine correct change given a cash register receipt and the denomination of a bill
- o 36 percent did not enter the correct number of exemptions on a W4 form
- o 26 percent did not determine if their paycheck was correct
- o 24 percent did not add their own correct return address to a letter
- o 22 percent did not address a letter well enough to ensure it would arrive at its destination
- o 20 percent did not comprehend an equal opportunity announcement
- o 20 percent did not write a check that would be accurately processed by a bank

The general magnitude of the A.P.L. results was supported by other major functional literacy studies of the 1970s. These

included the Survival Literacy Study (Louis Harris and Associates 1970), the Adult Functional Reading Study (Murphy, 1975), the Mini-Assessment of Functional Literacy (Gadway and Wilson, 1974), and military reports from Project REALISTIC (Sticht, Caylor, Fox, Hauke, James, Snyder, and Kern, 1972).

In 1986 the N.A.E.P. released a major study of the functional literacy abilities of 21- to 25-year-old young adults (Kirsch and Jungeblut 1986). This study selected items from previous N.A.E.P. studies as well as designing items based on what research indicated were reading tasks encountered by a substantial proportion of adults. More than 3,600 randomly selected adults were tested in their homes by more than 500 trained interviewers. The result is a study which is the most accurate available estimation of what young adults can capably read. In addition, selection of items from previous measures allows comparison of the performance of these adults to the performance of other individuals on other tests.

The items and results of this study are categorized and presented in terms of three types of literacy: prose, document, and quantitative. Prose literacy involves understanding and using information from texts (e.g., reference manuals, assembly instructions, maintenance procedures). Document literacy involves locating and using information in documents (e.g., job applications, payroll forms, schedules, maps, tables, indexes). Quantitative literacy involves applying arithmetic operations to information embedded in printed materials (e.g., computing

inventory, figuring a tip, completing an order form, determining the amount of loan interest from an advertisement).

Not all subjects attempted all the test items. An extremely simple pre-test eliminated from full testing subjects judged to have such limited literacy skills that the literacy simulation tasks in the test would unduly frustrate and embarrass them. Only about 2 percent of the young adult population were estimated to be at this level. Between half of a percent and one percent of the total population reported being unable to speak English.

Like the A.P.L. study, the N.A.E.P. study did not directly address workplace literacy skill demands. Some items from the N.A.E.P. study, however, closely resemble workplace literacy demands and provide a sense of what proportion of the population can and cannot meet those demands. The N.A.E.P. results paint a picture of large percentages of the adult population having difficulty with the sorts of literacy skill demands present in many lower- and middle-level jobs.

A few observations about the results are in order. When viewing percentages of the total 21- to 25-year-old population, it appears clear that there is not a large degree of basic illiteracy. Over 95 percent of young adults can

- sign their names
- locate expiration dates on a driver's license
- locate a time on a meeting form
- enter a caller's number on a phone message form
- write about a job they would like

- enter personal information on a job application

For slightly more complex tasks, however, there is a much lower percentage of young adults able to meet basic skill demands. For example, only about 70 percent of young adults could

- write a letter stating that an error was made in billing
- use an index from an almanac or manual
- enter and calculate bank balances
- locate eligibility from a table of employee benefits

Only 10 percent to 40 percent of young adults were able to perform complicated, multi-step occupational literacy tasks, such as

- orally interpret distinctions between two types of employee benefits
- use schedules of departures and arrivals
- plan travel arrangements using flight schedules
- calculate and total costs from catalogues

In short, the sorts of tasks associated with growing service and technical occupations are the sorts of tasks that significant numbers of young adults were unable to successfully perform.

Racial and Ethnic Disparities in Performance. The reported performance of young adults can be somewhat deceptive since the totals are for average performance. The N.A.E.P. study did not report data by socioeconomic status, but it did report data by racial and ethnic groups. In urban areas and vocational programs that serve significant numbers of learners who are minority poor,

the picture is more bleak.

There are wide racial and ethnic differences in the young adult data. The data indicate that it is probable that 98 percent of whites could fill in a job application while only 82 percent of blacks and 92 percent of Hispanics would be able to successfully complete the same task. Though a vast majority of all ethnic populations can accomplish basic literacy tasks, gaps in populations become wider as the complexity of tasks increases. For example, it is probable that 22 percent of whites would have difficulty writing a letter to state that an error was made in billing. On the same item, 60 percent of blacks and 42 percent of Hispanics would be likely to have difficulty. Test data indicate that it is probable that 35 percent of whites would have difficulty following directions to travel from one location to another using a map. On the same item, 80 percent of blacks and 63 percent of Hispanics would be likely to have difficulty. Items at slightly higher levels are extremely difficult for all populations. For example, an item on the prose scale asks individuals to orally interpret distinctions between two types of employee benefits. Nearly 90 percent of whites, 99 percent of blacks, and 97 percent of Hispanics would be likely to experience difficulty with this literacy task. Comparable percentages of all populations would be likely to experience difficulty calculating and totaling costs based on item costs from a catalogue.

The young adults who were tested using N.A.E.P. simulations of functional literacy tasks also responded to items included in

an earlier N.A.E.P. school literacy assessment. This allows a comparison between the performances of students in grades four, eight, and 11 and the performances of young adults. The data indicate that only about six percent of the young adult population read below the fourth-grade level, but 20 percent read below an eighth-grade level and nearly 40 percent read below an 11th-grade level. These totals are somewhat deceptive, however, due to wide racial and ethnic disparities. Nearly 18 percent of black young adults read below a fourth-grade level, close to half read below an eighth-grade level, and more than two-thirds read below an 11th-grade level. Hispanic young adults perform somewhat better than blacks, but nearly 30 percent read below an eighth-grade level and close to one half-read below an 11th-grade level.

Substantial numbers of young adults, especially blacks and Hispanics, are ill-equipped for the already high and ever-increasing literacy demands encountered in most jobs and daily living situations. For members of these groups to be productive and self-sufficient in our society, appropriate intervention strategies will need to be implemented.

In a study to identify major trends and events that could influence vocational education in the 80's, Lewis and Russell (1980), make this observation:

> Educationally disadvantaged groups will comprise a larger percentage of vocational education enrollment. . . .This implies a complementary program of remedial basic skills courses along with the regular vocational/occupational skills course. (p. 150)

Given the significantly large numbers of disadvantaged youth and young adults currently unable to meet the literacy skills requirements of most jobs, vocational educators face a major challenge.

Relationship of Literacy Skills to Job Performance

An underlying assumption behind concern about literacy skills levels in the workplace is that job performance is related to workers' literacy skill levels. The research suggests that there is a relationship but that it is by no means overwhelming or direct.

Most research about the relationship of literacy to job performance is sketchy and based upon information obtained from military studies. Kulp (1974), in a controlled study, found that performance of an assembly task decreased significantly when worker reading skills were more than two grade levels below the difficulty level of instructions.

Sticht (1975a), in Reading for Working, reports correlations of reading ability to job sample performance that range from r=.26 to r=.37. These correlations are significant but only explain from eight percent to 13 percent of the job performance variance. A good deal more than basic reading ability as measured by a reading test is needed to explain job performance ability. Sticht's (1982) review of basic skills training in the military notes that

> the most highly skilled, non-high school graduates in one study had a job success rate equal to those having the lowest basic skill levels among high school graduates. Thus basic skills competence per se does not

> appear to be the overriding determinant of success in the military. (p. vii)

By way of contrast, Hunter and Hunter (1984) meta-analyzed the results of hundreds of studies designed to predict job performance and found reading ability to be a significant predictor of job performance. Though Hunter and Hunter did not directly address literacy skills tests, they did include tests of reading ability in the general category of "cognitive measures." Hunter and Hunter claim that cognitive measures tend to correlate at the $r = .5$ to $r = .6$ level (25 percent to 36 percent shared variance) with job performance. This is not a sure bet, but research suggests it is a better bet than many other commonly used predictors of job performance. In every job family without exception, cognitive measures were predictors of job performance superior to measures of either perceptual or motor abilities. Indeed, cognitive measures were more effective predictors of job performance than biographical inventories, biographical interviews, expert recommendation, or the amount of previous education.

More recent research has attempted to identify how reading abilities interact with job performance. In two testing and observational studies of the relationship between performance and literacy abilities among nurses (Mikulecky and Winchester, 1983) and among electronic technicians (Mikulecky and Ehlinger 1986), the researchers note a low-level relationship between simple, literal level reading ability and job performance. A much higher relationship was noted, however, between job performance and the

ability to apply and use reading, writing, and computation skills critically. This same call for higher-level use of literacy skills may explain the high relationship between "cognitive measures" of ability and job performance presented by Hunter and Hunter (1984).

The survey by the Center for Public Resources (Henry and Raymond, 1982) takes a different perspective on the role of basic skills and job performance. Survey respondents were not as concerned about overall correlations between general basic-skills levels and performance as they were about costly one-time mistakes resulting from low basic skills. Examples cited include workers accidently killed because of inability to read warning signs, costly mistakes made because of inability to comprehend correspondence, and time lost due to the need to give regular lectures on the use of equipment as opposed to step-by-step written instructions (p. 18). Low ability levels in applied computation and measurement, according to respondents, regularly accounted for losses in production, quality, and general corporate performance (p. 20).

To summarize, literacy skills do appear to be related to job performance in at least two ways. Reading ability, as indicated by higher-level problem-solving and metacognitive skills rather that factual-level reading ability, appears to be a significant predictor of overall job performance. In addition, extremely low-level basic skills appear to be related to costly and dangerous mistakes in the workplace. The best workers can

communicate and use print to solve problems. The least effective workers do not use print in such ways and may be prone to costly, dangerous errors in situations calling for the use of basic skills.

How Generic and Transferable Are Literacy Skills?

It has been clear for quite some time that increased literacy skills training is a requirement of good job training. What has not been as clear is how to most cost-effectively provide such training. During the 1970s and early 1980s, experts had limited knowledge of how to most effectively design programs to incorporate literacy skills into job training. The usual procedure was to send students to remedial programs to get better at reading, computation, and whatever else they needed. The assumption was that once the "basics" had been learned, they could easily transfer to the workplace or vocational training. A major challenge for this approach was determining exactly what was basic. Determining key competencies and divising curricula were thus central tasks. A second line of thought noted that people tended to learn better when the basics were integrated with actual job training, and that "school work" didn't seem to transfer very well to actual workplace applications. Researchers even questioned the assumption that there were "generic" transferable skills. Instead, some researchers concluded that people learned what they are taught and not a lot more.

Researchers from each school of thought share the goal of improving the literacy skills competence of vocational students.

Research has begun to accumulate which partially supports the assumptions of each position. For example, analysis of the documents and observations of workers from several occupations reveals many seemingly shared skills that cross occupational lines. (Greeno, 1987; Greeno and Smith, 1986) On the other hand, there appear to be considerable limitations on the degree to which reading learned in one setting can easily be transferred to other settings (e.g., reading a story or a workbook is of little help in reading a manual or following a trouble-shooting guide).

Problems of Transfer. Even though it is possible to note similarities across occupational and school settings, researchers have found transfer on the part of learners to be severely limited. They observe that one problem with the generalizable skills approach is that skills differ so much from task to task. A skill used one way for one task, may be use differently to complete a similar task in a different job context. For example, Duffy (1985) writes

> To the extent that the newspaper and the job manual have different subject matter (the concepts discussed), different information access or referencing systems, and different writing styles and information display strategies, there will indeed be little transfer. If we consider how the function of graphics differs between a technical manual and a newspaper, we find that strategies one might teach for using graphics to understand (or find information in) a newspaper might even hinder (produce negative transfer) effective use of technical manuals. . . The point is that reading is not a unitary concept. Transfer from one reading task to another depends on the similarity of the components -- the processing requirements -- of the tasks. If instruction in reading the technical manual does not transfer to reading the newspaper, literacy instruction based on the newspaper would probably not transfer to the technical manuals (and reading the technical manuals

is, indeed, the goal of the instruction). (pp. 449-450)

Mikulecky and Ehlinger (1986) also point out problems related to skills transfer from classroom to workplace. The differences between job literacy and school literacy may explain, in part, the disturbing phenomena of limited transfer from gains in the general school literacy abilities to comparable gains in the workplace.

Much schooling is based, both consciously and unconsciously on the assumption that basic learnings and skills easily transfer from one situation to another. In school, student reading is largely limited to a relatively small amount of textbook reading (Mikulecky, 1982; Smith and Feathers, 1983). Only three percent of student writing is as long as a paragraph in length and the majority of writing is in response to text or worksheet questions (Applebee, 1981). It is generally assumed that students who perform such school literacy activities adequately will transfer their abilities and be prepared for literacy demands outside of school.

Research results on the transferability of training challenge these assumptions, however. For example, military research indicates that recruits given traditional literacy skills training make gains while in class but tend to revert and lose their skills within eight weeks (Sticht, 1982). Specific job-related literacy and computational skills programs are exceptions to this pattern. For example, Sticht reports that

> personnel retained 80% of their end-of-course gain in job literacy training, and only 40% of their end-of-

course gain in general reading. (p. 40)

Most recently Kirsch and Jungeblutt (1986) report limited correlations between individuals' abilities to read prose, documents and forms, and read material calling for use of computation. Test scores for these different reading tasks tend to correlate at the r = .5 level. This suggests about 25 percent shared variance among tasks. It may indeed be that there is some transfer or generalizability among skills but that it is limited to only about 25 percent. The rest of performance ability may be explained by background knowledge, experience, general intelligence, and a host of other factors.

Until more evidence accumulates on the degree of transfer and which skills are generic and to what extent, caution is in order. It is useful to know similarities across occupations, but evidence suggests it is not warrented to assume that observed similarities imply transfer of training. Indeed, the most effective job literacy training programs (Mikulecky & Strange, 1986; Sticht & Mikulecky, 1984) appear to integrate literacy skills training with actual job training thereby avoiding the risk of mistakenly assuming transfer or mistakenly counting on generic skills.

Effective Training Programs

A number of successful basic skills programs in the military employ a job-oriented approach to training personnel. One of the first to apply a functional literacy approach using reading materials found in the work place was the U.S. Army Functional

Literacy Training (FLIT) program, which found occupation-specific approaches using actual job materials to be successful (Sticht 1975, 1982).

The FLIT program developed materials based on the results of interviews with military personnel who were asked to identify the reading tasks performed on the job in the last 48 hours. Teaching materials were developed using the tables of contents, indexes, tables and graphs, forms, procedural information, etc, that were needed to perform on the job. Evaluation data (Sticht 1982) for more than 700 students showed that

- Students made three times the improvement in job-related reading as in general reading, indicating that they were learning what was being taught.
- Students in the FLIT program performed three times better than comparable students in other Army and Air Force programs, indicating that general literacy training does not make as much impact on job-related reading as does job-related reading training.
- Retention studies indicated that eight weeks after FLIT training, personnel retained 80 percent of their end-of-course gain in job-related reading but only 40 percent of their end-of-course gain in general reading.
- Many students in the FLIT program made little

gain and failed to master or even attempt some instructional modules and activities, suggesting the need for a longer period of development for some Army personnel.

Another highly successful military program is the Navy's Job Oriented Basic Skills (JOBS) program, the military's first attempt to apply the FLIT'S functional literacy development principles to basic skills in preparation for highly technical areas. The JOBS objective is to provide instruction "that would enable lower aptitude personnel to increase their mastery of selected basic skills and knowledges enough to permit them to enter and complete" apprentice-level training (Duffy 1985).

The Army's FLIT curriculum has been described by Duffy as an "exemplary program" (Duffy 1985), and has been a model for developing other programs in the Navy, Air Force, Marines and National Guard. An occupation-specific approach has been applied to more highly technical areas, such as the Navy's JOBS program described above. Other programs include the Army's recruit-level lower-literate program, BSEP I and II, as well as its comprehensive basic skills curriculum, JSEP I and II. The Air Force's Job Oriented Basic Skills Assessment and Enhancement System and the Army's STARS program both have been developed with an occupation-specific approach that requires students to read job related materials and solve problems in simulated workplaces. STARS employs video-disc technology and makes the learner a member of a space team with a number of tasks to perform.

Students are required to read written instructions from notes and warnings on the wall, follow directions, and monitor supplies. Student responses provide assessments of skill levels and branch to the appropriate levels on the video disc.

Other basic skills programs that apply the functional literacy approach to teaching and integrating basic skills have been developed in the public/private sector (Mikulecky and Strange, 1986; Sticht and Mikulecky 1984). For example, a joint public/private venture trained CETA-eligible word-processor operators in a program that integrated basic skills training with job training and used performance levels of employed word-processor operators as criteria for program completion. Training applicants were carefully recruited and screened, with special emphasis placed on selecting individuals who were not only CETA eligible but who were also likely to succeed. Classes of 30 to 35 trainees were accepted into the program. These individuals were paid to attend training 40 hours per week. Each day included language training, typing and word-processing training, work habits training, and individual study time. Three full-time teachers (a reading specialist, a word-processing specialist, and a business specialist) worked with students throughout the day and planned assignments that integrated language and machine skills. Much of the classroom work simulated actual job demands: Students composed business communication that other students edited and later produced in final form on word-processing equipment. A good deal of the work involved using actual

business communication that was handwritten in rough draft with editing notations.

The most clear-cut differences between this program and traditional basic skills programs related to the application and integration of training. Trainees actually used up-to-date word-processing equipment and were aware of the industry standards they had to meet. Their training in language, work habits, and machine use was integrated so that they received focused practice to meet those standards. Unlike much current schooling, the cooperative program assumed no guaranteed transfer of basic skills training; instead the program used job simulation as a major training device.

The time needed for trainees to reach job-level competence varied. The earliest trainees were able to find employment in 14 weeks of training. The average time needed for the screened applicants to reach the preset standards was 20 weeks, and a few trainees took nearly 28 weeks. In spite of economic difficulties that adversely affected hiring in the area, slightly more than 70 percent of trainees found word-processing employment within six months after completing the program.

Another successful program integrating basic skills and job training (Mikulecky and Stange, 1986) involved the retraining of workers for the new basic skills and technical demands of a job that was changing. An urban municipality had recently opened a new wastewater treatment plant as a result of new clear water guidelines. The plant incorporated several technical

innovations, and workers who needed little technical training to work in the old treatment plant now faced an entirely different situation. Before workers could be transferred to the new plant, they needed to be retrained in how the new process and equipment functioned, what safety precautions to use when working with a variety of dangerous gases, and how to maintain the microorganisms essential to the wastewater treatment.

An engineering consulting firm set up a cooperative relationship with a university consultant and hired a university-trained reading specialist to develop a basic skills component for the retraining program. The major academic goal was to help trainees gain mastery of technical vocabulary, concepts, and materials. The reading specialist set up special study guides to break down assignments into manageable tasks, and in some cases rewrote or redesigned training materials to lower difficulty levels. By working cooperatively with the reading specialist, teachers made modifications to traditional reading assignments and introduced key vocabulary prior to making those assignments.

The basic skills component of the retraining program can be judged a success by several standards. Nearly half the students who took special basic skills training passed their technical class posttests. It was the consensus of both technical instructors and of the reading specialist that fewer than five percent of these students would have passed without the special attention they received. Of the students who attended sessions, 70 percent were able to summarize materials in their own words by

the end of training. Retention of students receiving special basic skills training was actually higher than that of students who only attended technical classes. Gains in general reading ability were less encouraging. Only about 10 percent of the students taking special training made noticable gains in their ability to read general material or new material for which they had received no direction or purpose provided by the teacher. According to the reading specialist, students making the most significant gains in job and general reading ability invested five or more hours per week in outside reading of material at an appropriate difficulty level.

Characteristics of Effective Programs. There are several conclusions suggested by the civilian case studies, and military programs. It does appear possible to make fairly rapid gains in the ability to comprehend technical material if training is focused on that material. General literacy improvement, however, was not a noticeable, direct by-product of any programs but did occur with sufficient time on task (five hours per week) in the waste water treatment program with appropriate general material. Best results seemed to occur when basic skills training was integrated with technical training. Training that employed job simulations and literacy applications increased trainee time on task. In the civilian programs, actively involved students received up to three times more practice per paid day than did traditionally trained students. The integrated program, therefore, is also more attractive from a cost-effectiveness

perspective.

Probably the most significant conclusion to be drawn from programs in the private sector is that successful technical and basic skills training programs are beginning to emerge in the vacuum left unfilled by traditional schooling. Where schools are unwilling or unable to match basic skills training and materials to specific occupational needs, private consulting firms are successfully filling the gap. They are successful to the degree that they do not assume transfer from general basic skills training to specific job training. Matching training to the application required on the job appears to be key.

References

Applebee, Arthur. Writing in the Secondary School. NCTE Research Report 21. Urbana, Il: National Council of Teachers of English, 1981.

Bormuth, J. R. "Reading literacy: Its definition and Assessment." In. J. B. Carroll & J. S. Chall, eds., Toward a Literate Society (pp. 61-100). New York: McGraw-Hill, 1975.

Cook, W. Adult Literacy Education in the United States. Newark, Del.: International Reading Association, 1977.

Diehl, W., and L. Mikulecky. "The Nature of Reading at Work." Journal of Reading, (24) 1980: 221-227.

Duffy, T.M. "Literacy Instruction in the Military." In Armed Forces and Society, Spring 1985, pp. 437-467. Inter-University Seminar on Armed Forces and Society, Spring 1985.

Gadway, C. and H. A. Wilson. Functional literacy: Basic Reading Performance. Denver, Colo.: National Assessment of Educational Progress, 1975.

DB

✓Greenin, James P. "The Development of Generalizable Skills Instruments for Identifying the Functional Learning Abilities of Students in Vocational Education Programs." Journal of Industrial Teacher Education, Summer 1982, pp. 19-36.

Greenin, James P., and B. B. Smith. Assessing the Generalizable Skills of Post-secondary Vocational Students: A Validation Study. Minneapolis: Minnesota Research and Development Center for Vocational Education, University of Minnesota, 1981.

Guthrie, J. T. "Equilibrium of Literacy." Journal of Reading, 26 (1983): 668-670.

Harste, J., and L. Mikulecky. "The Context of Literacy in Our Society." In A. Purves and O. Niles, eds., Becoming Readers in a Complex Society. 83rd Yearbook of the National Society for the Study of Education, Part I. Chicago, IL: University of Chicago Press, 1984.

✓Henry, J.F., and S. Raymond. Basic Skills in the U.S. Work Force. New York: Center for Public Resources, 1982.

Hunter, J. and R. S. Hunter. "Validity and Utility of Alternative Predictors of Job Performance." Psychological Bulletin, 96, no. 1 (1984), 72-98.

Hymowitz, L. "Employers Take Over Where School Failed to Teach the Basics." Wall Street Journal, January 22, 1981, p. 1.

Kern, R.P. "An Observational Method for Evaluating Use and Effectiveness of Technical Information Sources at a Work Site." In How People Use Technical Information on the Job. Washington, D.C.: American Institute for Research, 1980.

Kirsch, I., and J.T. Guthrie. "The Concept of Measurement of Functional Literacy." Reading Research Quarterly, 13 (1977-1978): 485-507.

✓Kirsch, I., and A. Jungeblut. Literacy: Profiles of America's Young Adults. Princeton, N.J.: National Assessment of Educational Progress at Educational Testing Service, 1986.

Kulp, M. "The Effects of Position Practice and Readability Level on Performance." Master's thesis, San Diego State University, 1974.

Lewis, Morgan V., and J.F. Russell. Trends, Events and Issues Likely to Influence Vocational Education in the 1980s. Columbus: Ohio State University: National Center for Research in Vocational Education, 1980. (ED195825)

Louis Harris and Associates. Survival Literacy: Conducted for the National Reading Council. New York: Louis Harris and Associates, 1970. (Also reported in The Congressional Record, November 18, 1970, pp. E9719-E9725.)

Mikulecky, L. and Strange, R. "Effective Literacy Training Programs for Adults in Business and Municipal Employment." In A Decade of Reading Research: Implications for Practice, edited by J. Orasanu. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1986.

DB ✓Mikulecky, L. "Job Literacy: The Relationship between School Preparatton and Workplace Actuality." Reading Research Quarterly, 17 (1982): 400-419.

Mikulecky, L., and D. Winchester. "Job Literacy and Job Performance among Nurses at Varying Employment Levels. Adult Education Quarterly 34 (1983): 1-15.

DB ✓Mikulecky, L., and J. Ehlinger. "The Influence of Metacognitive Aspects of Literacy on Job Performance of Electronics Technicians." Journal of Reading Behavior, 18 (1986): 41-62.

Mikulecky, L., Shanklin, N. and Caverly, D. Adult Reading Habits, Attitudes and Motivations: A Cross-Sectional Study. Teaching and Learning Series (monograph). Bloomington, In.:

School of Education, Indiana University (1979).

Murphy, R. T. "Assessment of Adult Reading Competence." In A. Nielson and J. Hjelm eds., Reading and Career Education, pp. 50-61. Newark, Del.: International Reading Association, 1975.

Negin, G., and D. Krugler. "Essential Literacy Skills for Functioning in an Urban Community, Journal of Reading, 24 (1980): 109-115.

Northcutt, Norvell. "Functional Literacy for Adults." In Reading and Career Education, Duane Nielsen and Howard Hjelm, eds., pp. 43-49, Newark, Del.: International Reading Association, 1975.

Rumberger, R.W. "The Growing Imbalance between Education and Work." Phi Delta Kappan 65 (1984): 342-346. (ERIC No. EJ 291 592).

_____. Demystifying High Technology. Occasional Paper No. 97. Columbus: Ohio State University, The National Center for Research in Vocational Education, 1984. (ED240305)

Book ✓✓Rush, T., A. Moe, and R. Storlie. Occupational literacy. Newark, Del.: International Reading Association, 1986.

Smith, F., and K. Feathers. "Teacher and Student Perceptions of Content Area Reading." Journal of Reading, vol. 26 (1983): 348-54.

Sticht, T. G. Reading for Working: A Functional Literacy Anthology. Alexandria, VA: Human Resources Research Association, 1975.

Sticht, T. G. Literacy and Human Resources Development at Work. Alexandria, Va.: Human Resources Research Organization, 1980.

Sticht, T. G. Basic Skills in Defense. Alexandria, Va.: Human Resources Research Organization, 1982.

Sticht, T. G., J. S. Caylor, L.C. Fox, R.N. Hauke, J.H. James, S.S. Snyder, and R. P. Kern, "Project REALISTIC: Determination of Adult Functional Literacy Skills Levels." Reading Research Quarterly, 7 (1972): 424-465.

Sticht, T. G., L. Amijo, R. Weitzman, N. Koffman, K. Roberson, F. Chang, and J. Moracco., Teachers, Books, Computers, and Peers: Integrated Communications Technologies for Adult Literacy Development. Monterey, Calif.: U.S. Naval Post-

graduate School, 1986.

Sticht, T. G. and L. Mikulecky. Job-Related Basic Skills: Cases and Conclusions. Information Series No. 285. Columbus: Ohio State University, The National Center for Research in Vocational Education, 1984. (ED246312)

Tyler, R. W. "Education for Functional Literacy: Old Problems, New Problems." Paper presented at a Conference on Functional Iliteracy, Indiana University, Bloomington, 1978.

Valentine, T. Issues Central to the Definition of Adult Functional Literacy. A paper prepared for the Office of Higher Education and Adult Learning of the Office of Educational Research and Improvement of the United States Department of Education, 1986. Contract No. OERI-P-86-3014.